The ToxGuide™ is developed to be used as a pocket guide. Tear off at perforation and fold along lines.

Sources of Exposure

General Populations

- Exposure of the general population to benzene is mainly through breathing air that contains benzene.
- The major sources of benzene exposure are tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.
- Vapors (or gases) from products that contain benzene, such as glues, paints, furniture wax, and detergents, can also be a source of exposure.
- About 50% of the entire nationwide exposure to benzene results from smoking tobacco or from exposure to tobacco smoke.

Occupational Populations

- Individuals employed in industries that make or use benzene may be exposed. These industries include benzene production (petrochemicals, petroleum refining, and coke and coal chemical manufacturing), rubber tire manufacturing, and storage or transport of benzene and petroleum products containing benzene.
- Other workers who may be exposed to benzene because of their occupations include steel workers, printers, rubber workers, shoe makers, laboratory technicians, firefighters, and gas station employees.

Toxicokinetics and Normal Human Levels

Toxicokinetics

- Absorbed benzene is rapidly distributed throughout the body and tends to accumulate in fatty tissues.
- The liver serves an important function in benzene metabolism, which results in the production of several reactive metabolites.
- At low exposure levels, benzene is rapidly metabolized and excreted predominantly as conjugated urinary metabolites.
- At higher exposure levels, metabolic pathways appear to become saturated and a large portion of an absorbed dose of benzene is excreted as parent compound in exhaled air.

Normal Human Levels

Blood

Median level in humans is 0.05 mg/L for non-smokers.
Range in humans is 0.03 to 1.88 µg/L.

Biomarkers / Environmental Levels

Biomarkers

- Benzene in urine is a sensitive biomarker of exposure down to 0.1 parts per million (ppm).
- The metabolites muconic acid and S-phenyl mercapturic acid in urine are sensitive biomarkers of exposure down to 0.55 ppm.
- Decreases in blood cell counts may indicate benzene toxicity to the hematological system.

Environmental Levels

Air

- Measured levels of benzene in outdoor air range from 0.02 to 34 parts per billion (ppb).

Water

- Because benzene can cause leukemia, EPA has set a goal of 0 ppb for benzene in drinking water and in water such as rivers and lakes.
- EPA has set the maximum permissible level of benzene in drinking water at 5 ppb.
- EPA recommends a maximum permissible level of benzene in water of 200 ppb for short-term exposures (10 days) for children.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Benzene (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

ToxGuide™ for Benzene

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U.S. Department of Health and Human Services
Public Health Service
Agency for Toxic Substances and Disease Registry
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ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Chemical and Physical Information

Benzene is a colorless liquid

- Benzene, also known as benzol, has a sweet odor.
- Benzene is highly flammable.
- Benzene is made mostly from petroleum sources.
- Various industries use benzene to make other chemicals, such as styrene (for Styrofoam® and other plastics), cumene (for various resins), and cyclohexane (for nylon and synthetic fibers).
- Benzene is also used for the manufacturing of some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides.
- Benzene is also a natural component of crude oil, gasoline and cigarette smoke.

Routes of Exposure

- Inhalation (breathing).
- Ingestion (eating or drinking).
- Dermal (skin) contact.

Benzene in the Environment

- Benzene is found in air, water, and soil.
- Industrial processes are the main sources of benzene in the environment.
- Natural sources of benzene, which include volcanoes and forest fires, also contribute to the presence of benzene in the environment.
- Most people can begin to smell benzene in air at 1.5–4.7 parts per million (ppm) and smell benzene in water at 2 ppm. Most people can begin to taste benzene in water at 0.5–4.5 ppm.
- Benzene levels in the air can increase from emissions from burning coal and oil, benzene waste and storage operations, motor vehicle exhaust, and evaporation from gasoline service stations.
- Since tobacco smoke contains high levels of benzene, tobacco smoke is another source of benzene in air.

Relevance to Public Health (Health Effects)

Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.

Minimal Risk Levels (MRLs)

Inhalation

- An MRL of 0.009 ppm has been derived for acute-duration inhalation exposure (14 days or less) to benzene.
- An MRL of 0.006 ppm has been derived for intermediate-duration inhalation exposure (15-364 days or less) to benzene.
- An MRL of 0.003 ppm has been derived for chronic-duration inhalation exposure (365 days or more) to benzene.

Oral

- No acute- intermediate- or chronic-duration oral MRLs were derived due to a lack of appropriate data on the effects of acute, intermediate or chronic oral exposure to benzene.

Health Effects

- The primary target organs for acute exposure are the hematopoietic system, nervous system, and immune system.
- The primary target for adverse systemic effects of benzene following low-level chronic exposure is the hematological system.
- Benzene is a known human carcinogen and is associated with leukemia, especially acute myelogenic leukemia.
- Benzene exposure may also be associated with reproductive and developmental effects based on animal studies.

Children's Health

- It is not known if children are more susceptible to benzene poisoning than adults.

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